SITE AND CONTRACTOR ACTIVITIES AND PROGRAMS
U. C. RADIATION LABORATORY

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The Radiation Laboratory handles I should guess over 99% of its isotope curies in erkeley boxes. Our air cleaning problems are so intimately connected with this concept that it would perhaps be helpful to show a few slides about boxes.

SLIDE 1 Observe in the middle a simple box shell. It is mounted on a so-called dolly with casters. Various kinds of equipment may be added to suit the job. Left and right are shown boxes equipped for fairly high levels of routine alpha work. On top notice filters in series terminated in a blower. The blower may discharge to a nearby hood or to manifolds constructed for the purpose. In passing, note each box is a complete laboratory.

SLIDE 2 Shows a closer view of a simple box. Note air inlet tubes at left and right lower corners. They distribute air which comes in the rear of the box via 1.3 micron fiberglass media. Observe the glass fume hood for close capture of airborne material during evaporating, fuming, grinding, etc.

SLIDE 3 Shows a box in a hood. Our hoods have two purposes (1) Stink chemistry with or without tracer work (2) secondary enclosures for "hot" boxes.

SLIDE 4 Showing two boxes hooked together for linear operations in this case housing (1) preparation area and (2) DC sparking area for spectrographic work. The spark is lit within a quartz tube; the resultant aerosol is flushed thru a 1st sampler, two CWS 6 filters, a final sampler, thence to another CWS 6 with general box air and out the stack. We have never had an airborne alpha contamination in the room although some of the sparked samples contained more than 10^{10} counts per minute. During the trial periods we captured the exhaust in evacuated tanks but never found any counts, hence the stack.

SLIDE 5 Showing how any room can be a multipurpose lab; four boxes exhausted via a common manifold. We've had nine boxes in one room.

SLIDE 6 When gammas are involved, we wheel a lead shield up, replace gloves with manipulators, add lead glass windows and continue. No change in ventilation requirements.

SLIDE 7 A shielded box for simple work.

SLIDE 8 A shielded box for a complex chemical sequence. The control panel handles electrical equipment inside.

SLIDE 9 Shown are some of the complex gear: hot and cold baths, reagents on a rotating rack; manipulator, pipettors and sampler in front.

SLIDE 10 A recently used shielded box with equipment in place.

SLIDE 11 A sequence of boxes for handling pile slugs: cutting, unloading, dissolving, complete chemistry, column separation and purification. Exhaust capacity about 30 CFM. A recent count showed we have put 266 boxes of all sorts to use; 135 of these are currently at work. The average exhaust rate each is possibly 10 CFM. Our air cleaning volume then for "hot" work is 1350 CFM. We have over 100 hoods handling either no activity or tracer and short half life stuff; they average about 1000 CFM each; a total of 100,000 CFM for the project. We don't clean this air. We think we can make a good case on ventilation alone for saving many thousands of dollars in not employing large CWS 6 filters and the costly gear: blowers, plenums, etc., needed by them in contaminated room-hood type operations. The hidden savings in manpower hours by not requiring special clothing, respirators, etc. is an incidental and valuable benefit difficult to assess cost-wise. Our associated waste disposal problems are reduced bulkwise because our little 8" x 8" filters operate on rigorously precleaned air and some have lasted more than 3 years as a consequence. This all sounds rosy. But the future is getting cloudy in the aircleaning field as we see it. Where we used to deal with microcuries we are with increasing frequency handling curie and larger quantities in a box. The usual air cleaning train ending with a CWS type filter is not always enough. A few counts are coming thru. Someone has to invent a better air cleaner; 99.96 % is not good enough for materials requiring confinement to the 10th decimal point of 9's. We are making a few advances in trying to prevent aerosolization at the operating point but this is difficult because some processes just can't be avoided or tinkered with. The use of ion exchange resins is a blessing in this direction removing as it does in many cases the requirement for extensive heavy chemistry and its concommitant aerosol formation and dispersion.

One of our continuing problems regarding air cleaning is mainly psychological. Graduate chemists come to us with a long training behind them dealing with non-radioactive materials. They are used to bench and hood work and the total enclosure or box idea is at first felt to hamper them. Conversion takes days for some, months for others. Occasionally, a convert is made dramatically as in the case of a gross spill on a bench top rendering months of work invalid in a lab now uninhabitable. Spills in boxes relatively speaking are easy to handle: we give the chemist a new box (sometimes in a matter of minutes) and he continues his work in the same room where he eats his lunch, smokes and writes his reports. And the contaminated ductwork and filters are a part of the removed box, not a part of the building.

In the slides, I showed a more or less standard basic box unit. Some applications demand special shapes. For instance in handling tritium we house an entire vacuum rack of glass apparatus in a box about 50 cubic feet in volume. We have enclosed sputtering devices, metal production units, mass spectrograph units and a host of other special equipment in odd sized enclosures. Ventilation-wise each supplies the same virtues: small air volumes, pre-cleaned operating air, a positive barrier between operators and contaminated air, small air cleaning equipment, readiness of disposal, small investment. It is true this concept seems suitable only to research lab scale work. We are realistic in not claiming to be able to box up an operating pile or separations plant. Yet it is interesting to find at times one of our chemists working in a box with quantities of materials which at some other site would be called production quantities, curie-wise. We don't place blind faith in any equipment, including boxes. We collect over 1000 air samples per month, analyzing for alpha and beta-gamma contamination. We have never had a beta-gamma contamination exceeding 10% of the daily maximum permissible exposure. Our alpha contamination has crept up in the last four years so that we now find about two samples a month reaching the level permitted for everyday exposure. This is disturbing even when one realizes the curies of material handled today is at least 100,000 times what it was in 1949.

Part of the cause lies in pure arithmetic: where a 0.01% loss was undetectable in 1949, today it is detectable. Part is due to higher specific activities of the isotopes being handled. They seem to behave differently.

Up to this point my remarks have been emphasizing our air cleaning problems as regards keeping the activity confined to the operating volume of the enclosure. We should also recognize the impact of what gets into the operating enclosure from the outside. Since the results of much research work are based on a final sample wherein perhaps a few counts per hour may be the basic data it is apparent that cross contamination can be dictating the validity of much research endeavor. Thus non-contaminated supply air is essential; this demands an air cleaning program of good efficiency. Our boxes have enjoyed this all along, as mentioned. There is a threat however. As contaminants increase in quantity the requirements must be beefed up. As atmospheric background goes up due to Uncle Joe's shots we can possibly forecast the need for supplying cleaned air to counting devices not normally so supplied. Recently we collected atmospheric contaminants blowing in off the Pacific containing 0.2 counts beta-gamma per hour in a 500 cc volume with an apparent half life of 19 days. This is a substantially greater quantity than previously found at Berkeley. The trend has been rapidly up in the last 24 months. What the next few years will bring I cannot estimate. These remarks pertain of course to purely technical problems, not health hazards. These latest air pollution values are still 1/150th the health hazard level.

To summarize, we can report from the Radiation Laboratory:

A. As to the past:

1. Our stack gas air cleaning program has worked pretty well. We handle about 1350 CFM of air at good cleaning efficiency, at minimum cost in investment and maintenance.

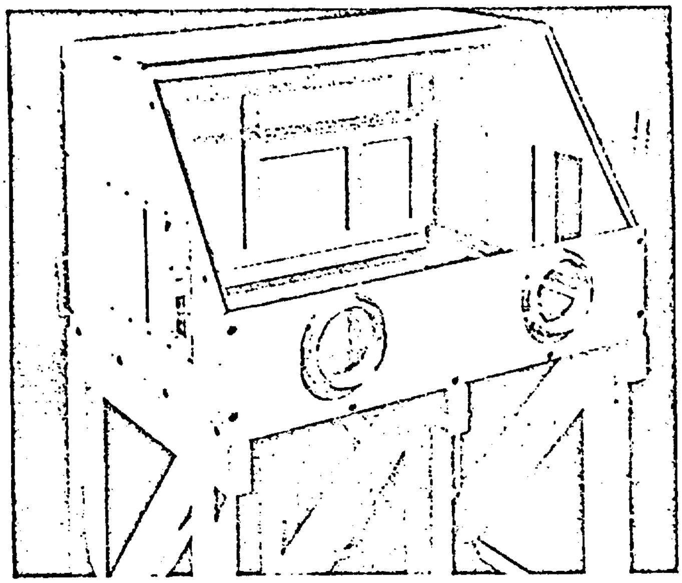
2. Our supply air cleaning program likewise has been technically adequate.

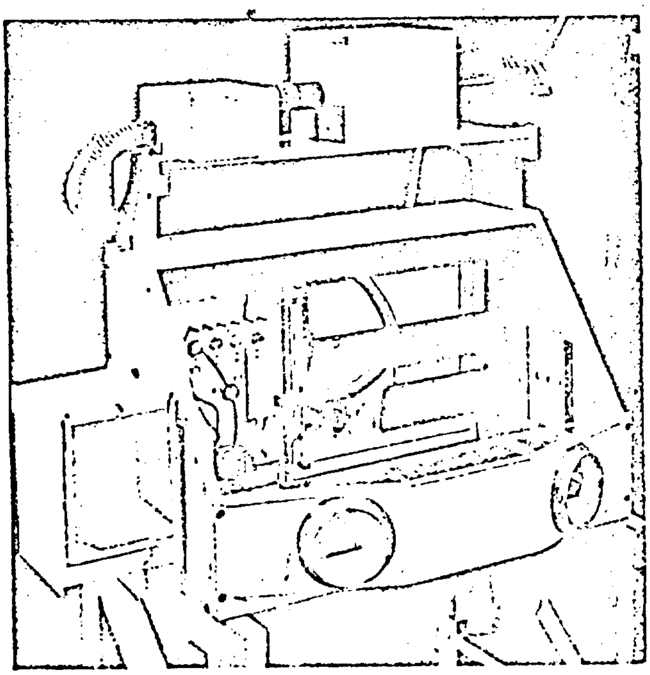
B. Regarding the future:

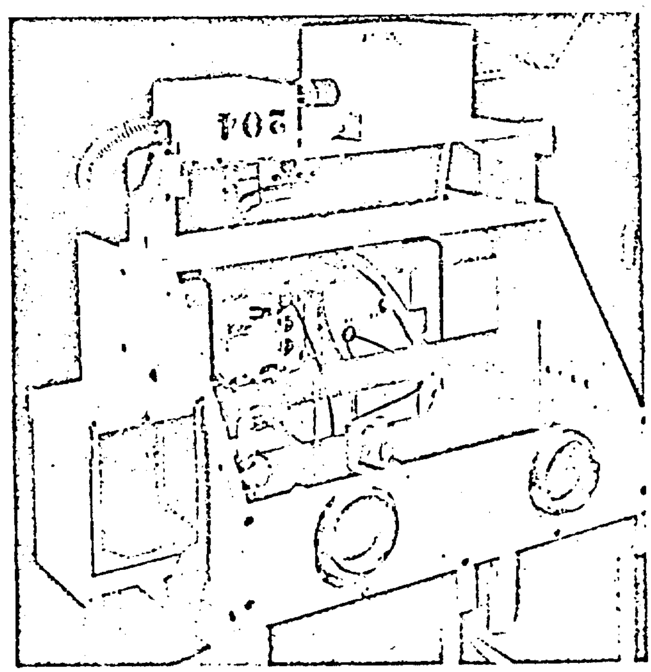
1. Recent and probable future increases in specific activity and quantities of research material handled suggest the need for greatly increased off-gas air cleaning

efficiency beyond that obtainable from traditional devices ending in CWS 6 type filters.

2. Cleaned supply air may be required in certain research devices and areas not now needing it because of increases in radioactive atmospheric pollutants resulting from detonations of foreign and domestic nuclear devices.







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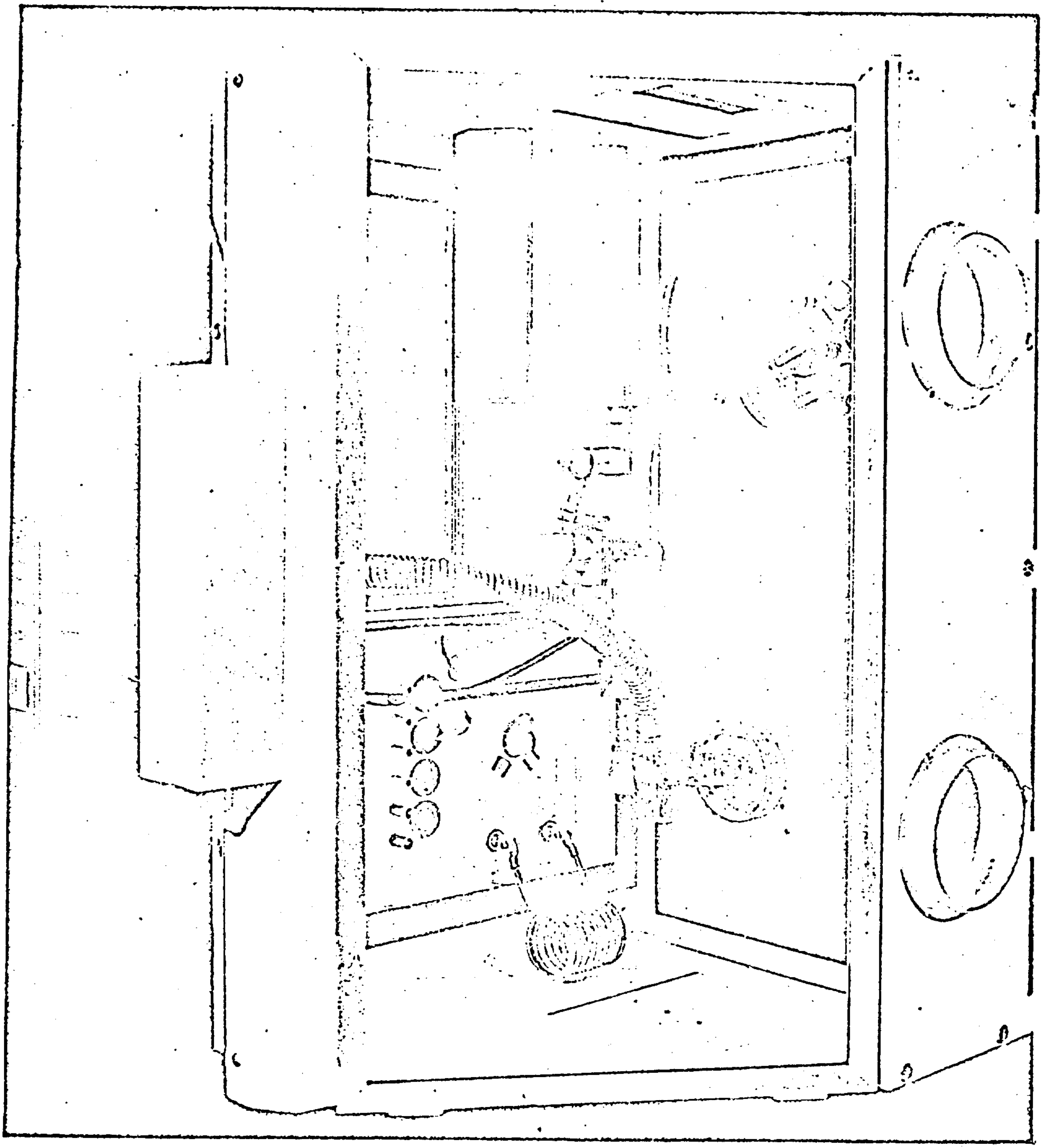

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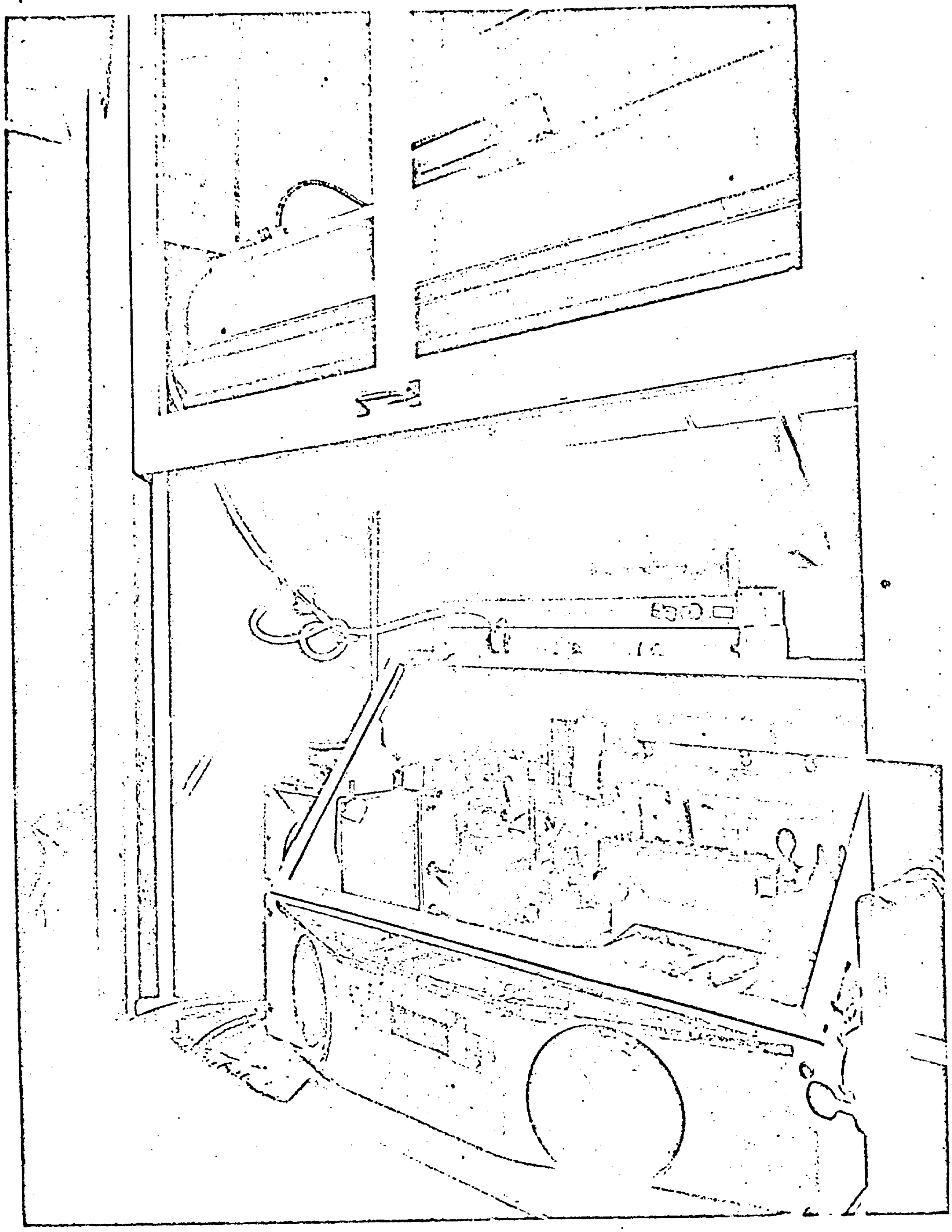

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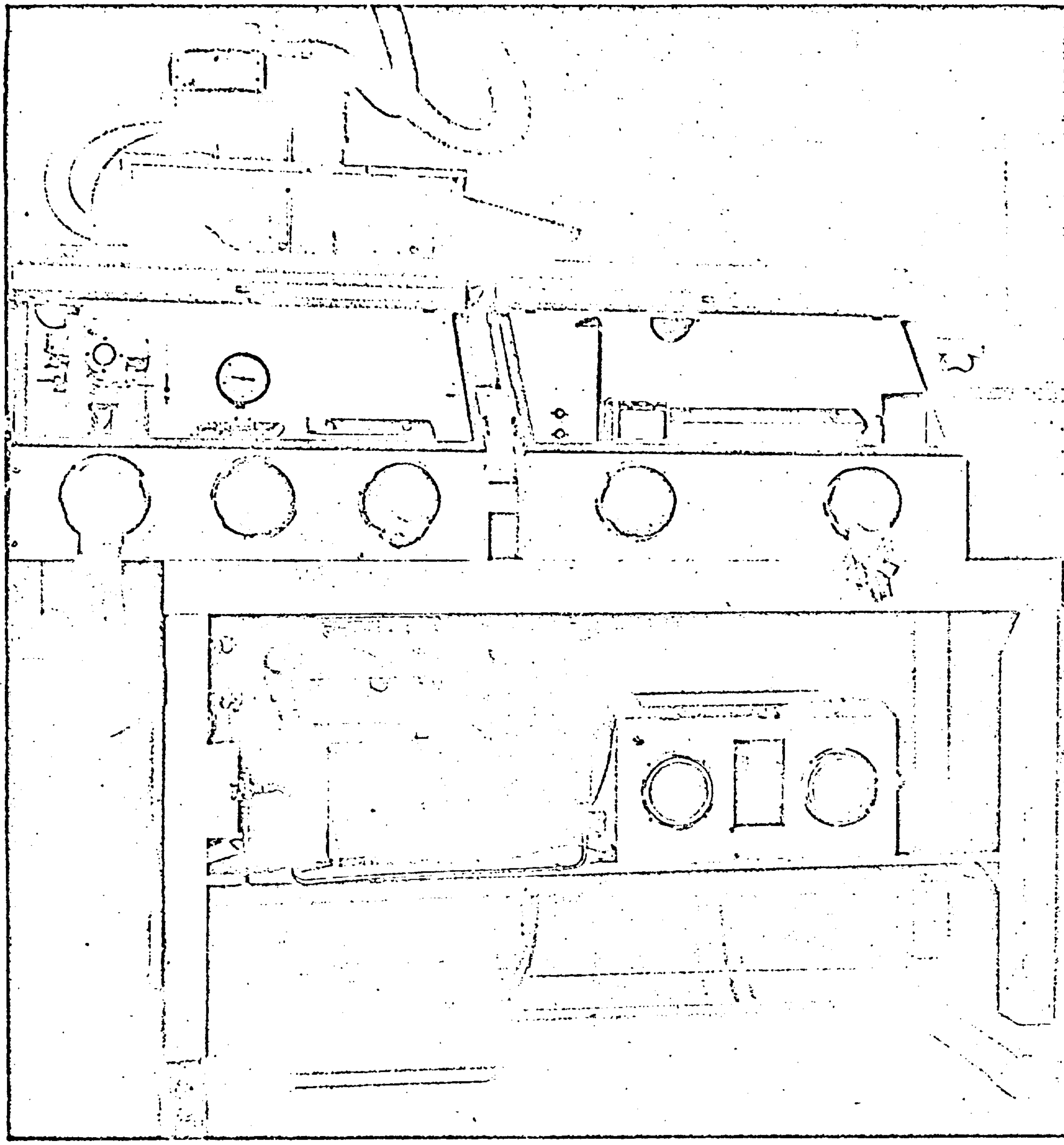

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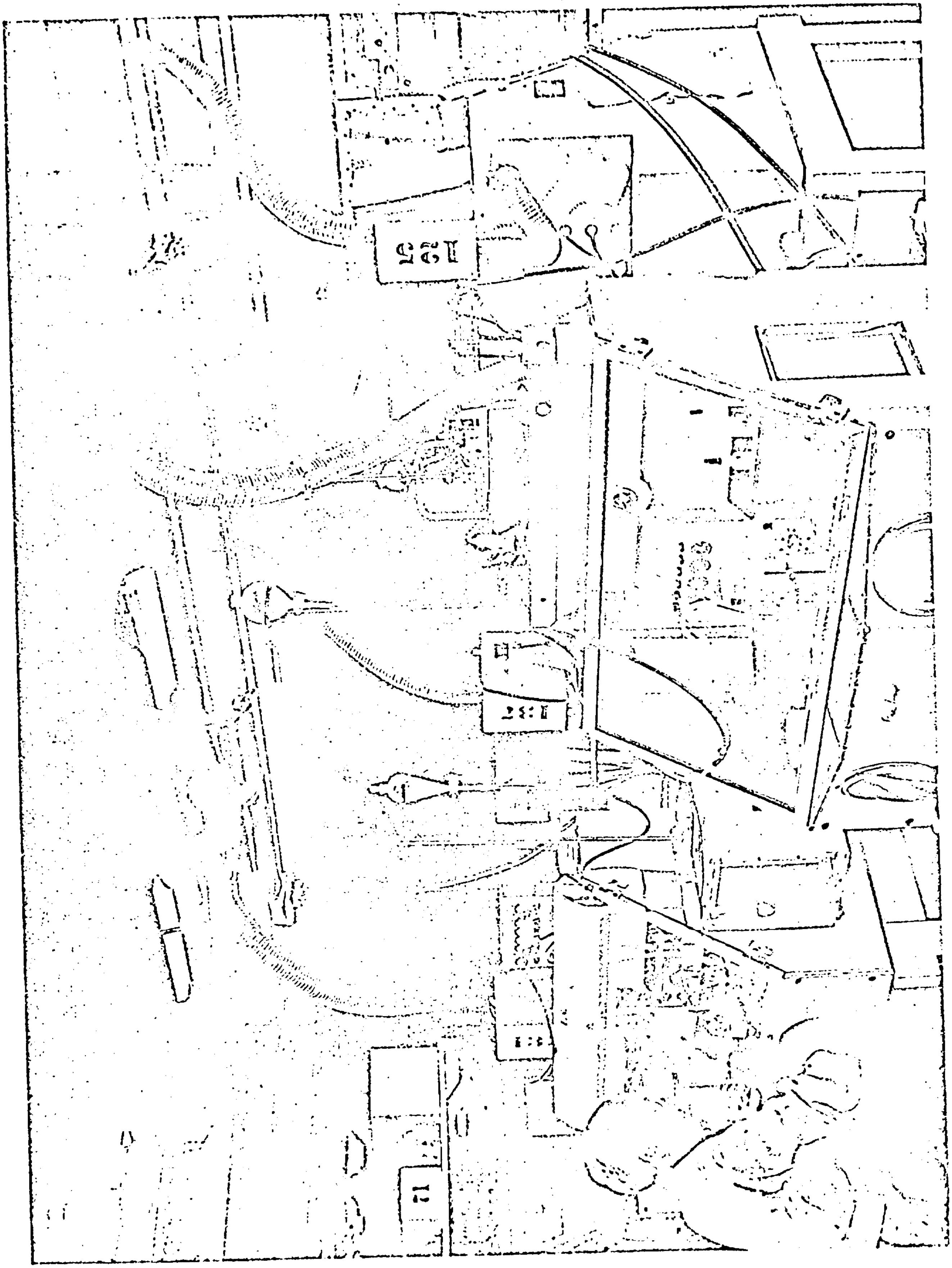

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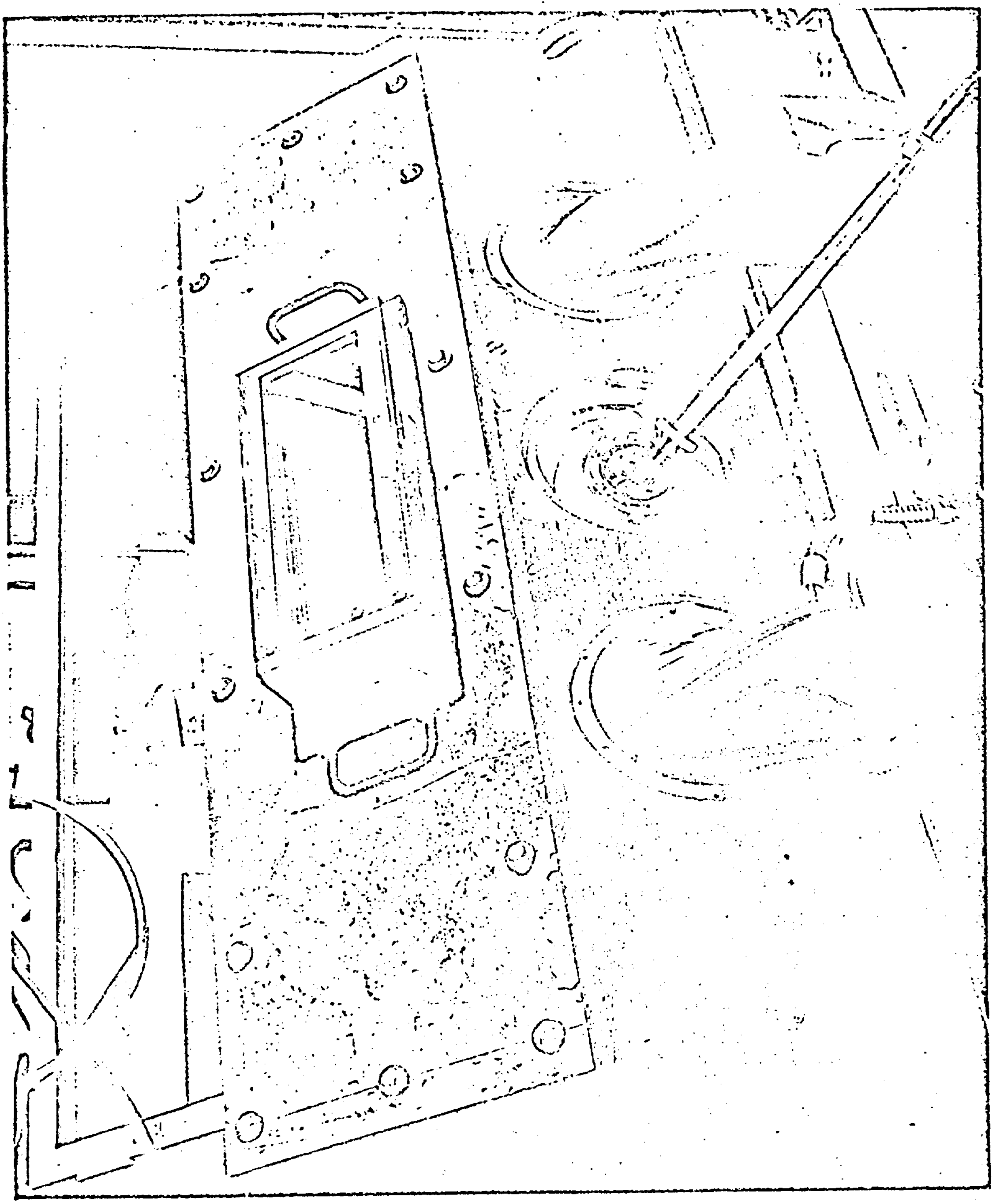

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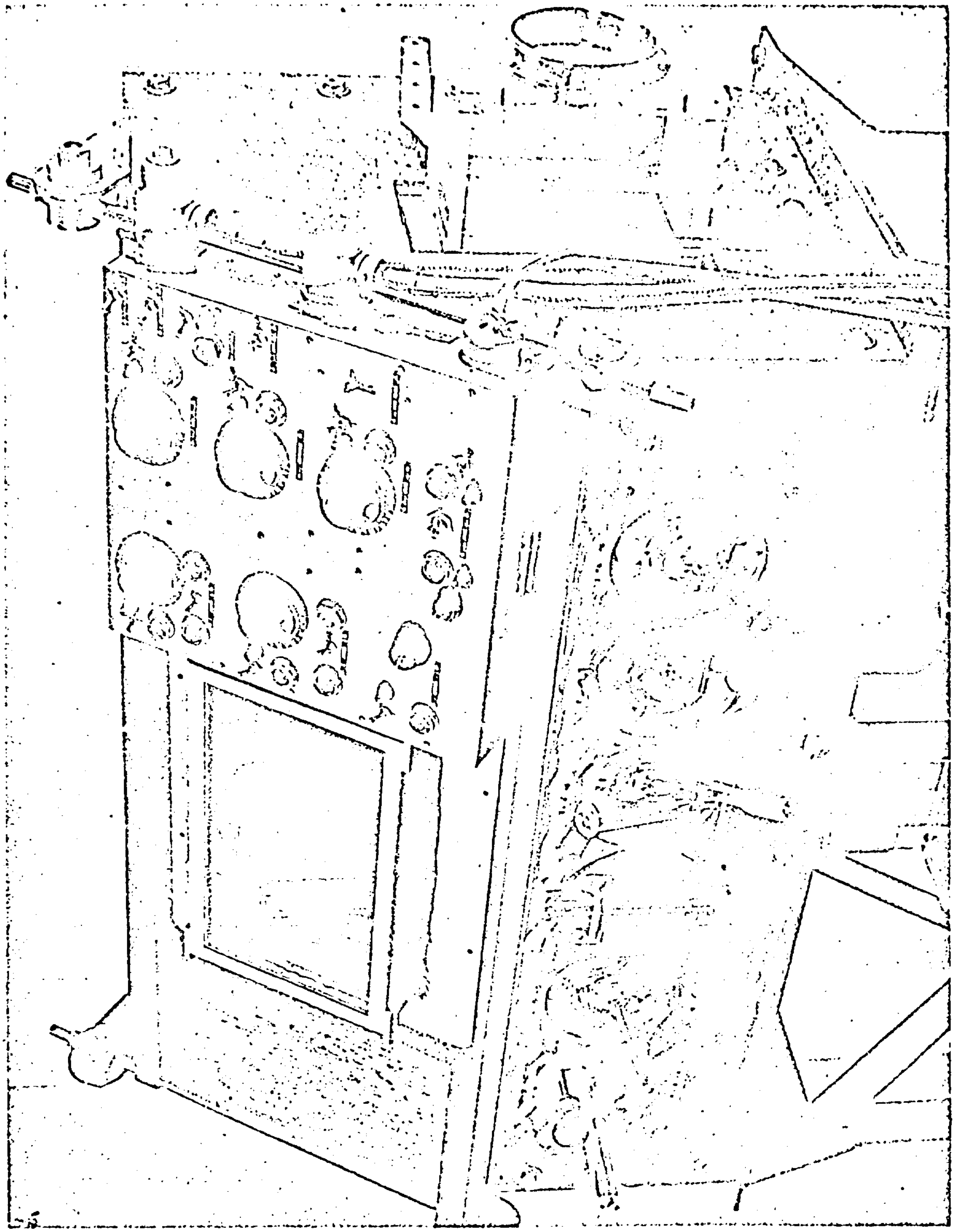

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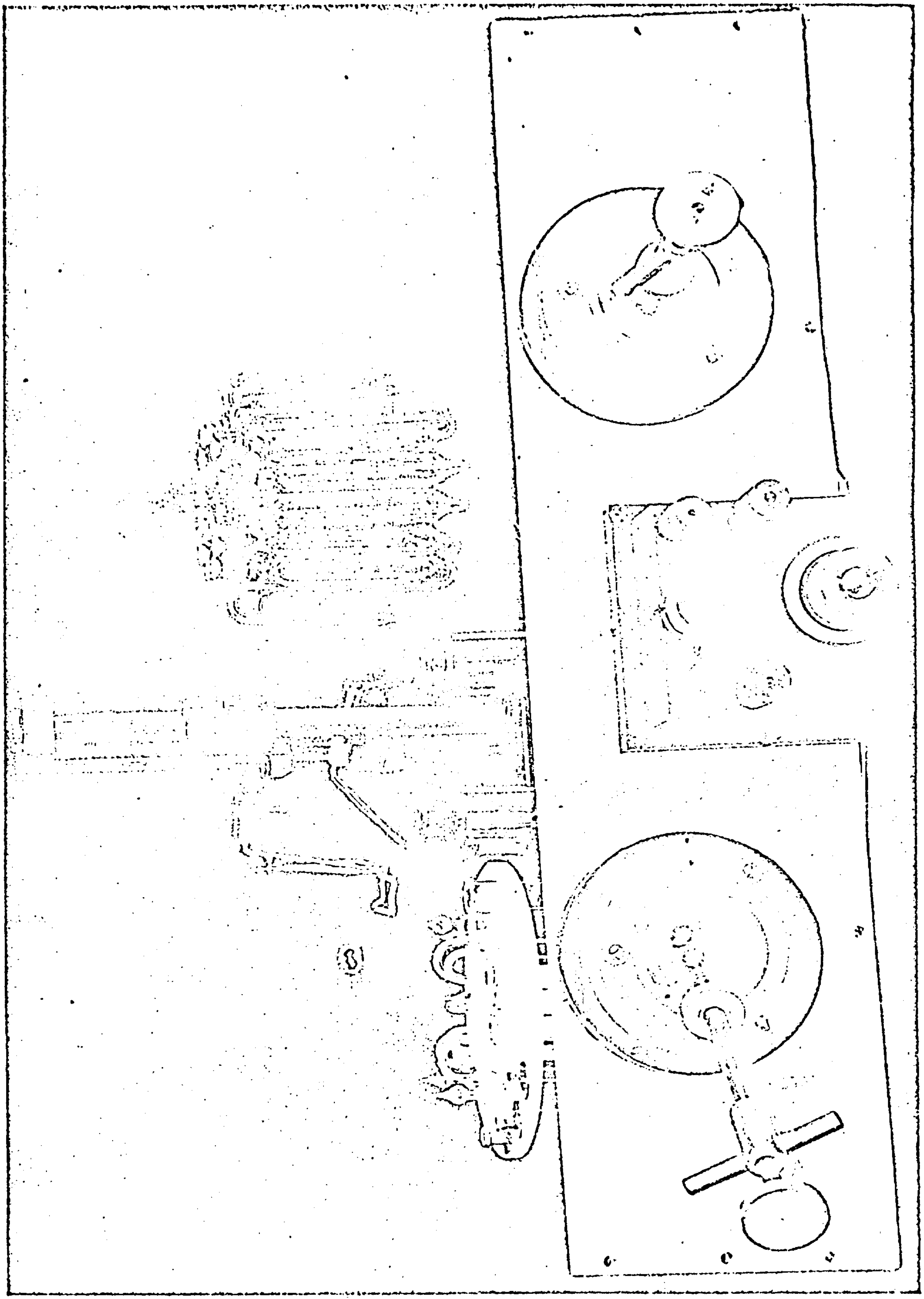

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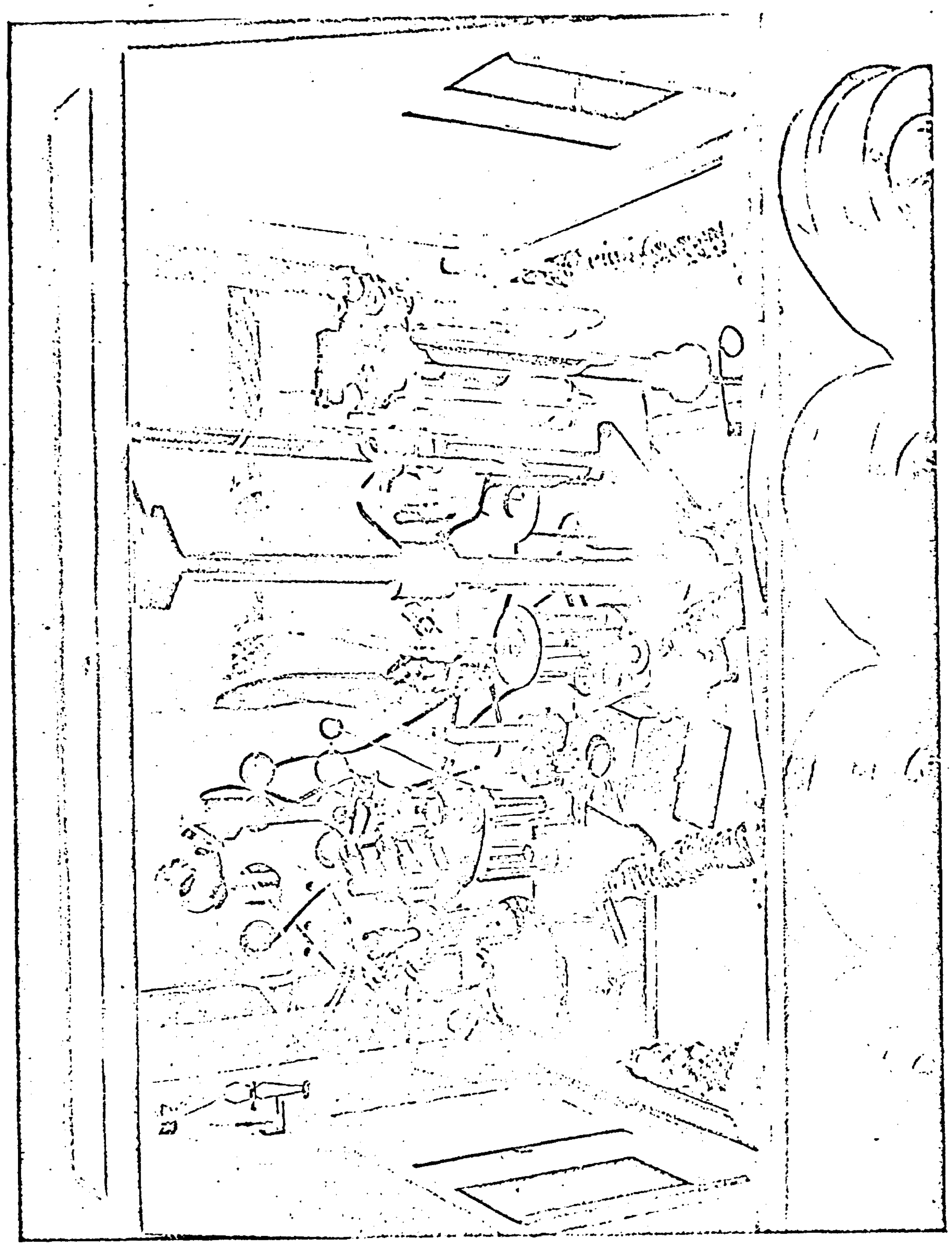

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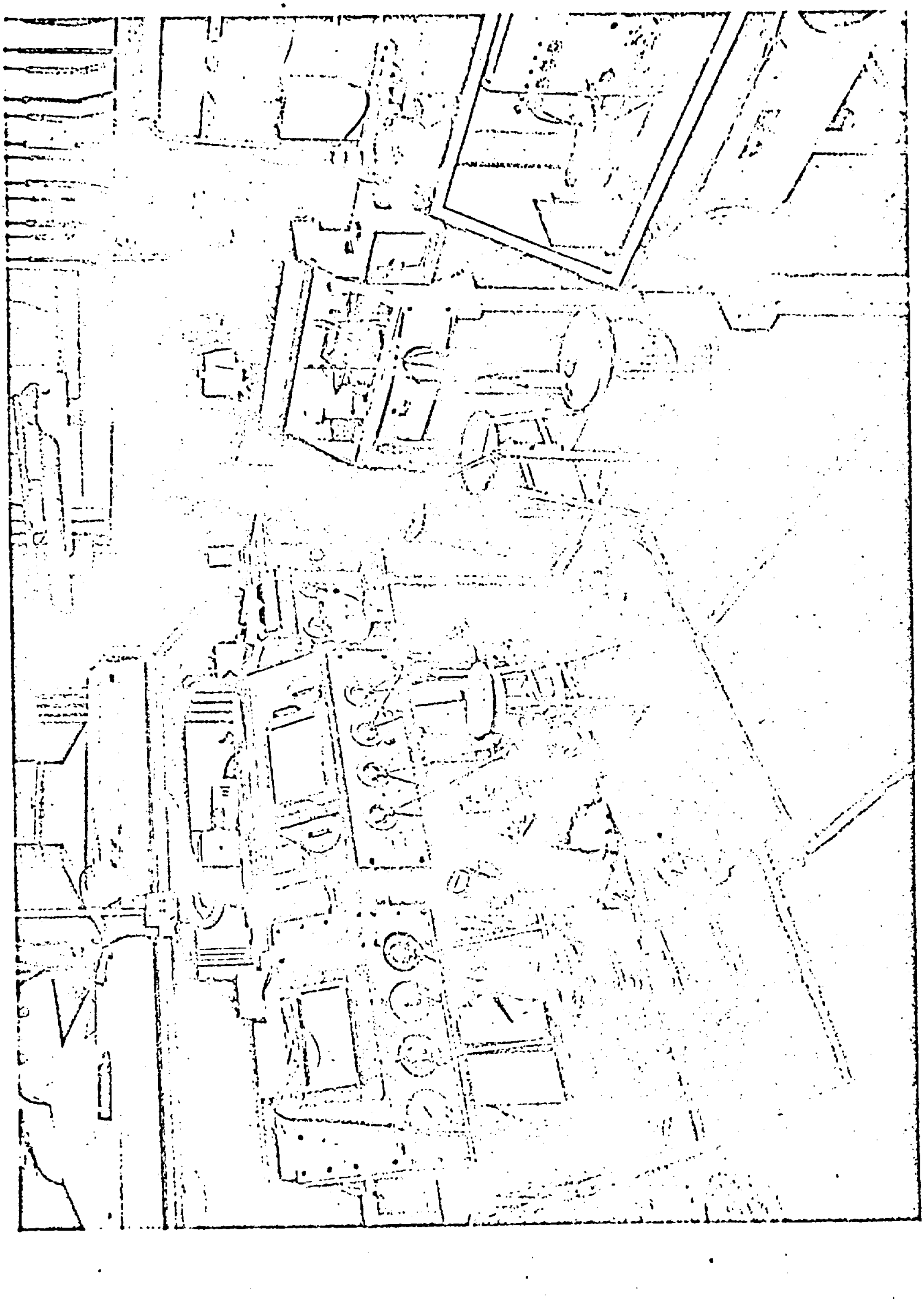

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